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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/813,377	03/30/2004	Mai H. Loc	P18194	4695

28062 7590 03/27/2009

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EXAMINER	
PATEL, RAJNIKANT B	
ART UNIT	PAPER NUMBER
2838	
MAIL DATE	DELIVERY MODE
03/27/2009	PAPER

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UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE BOARD OF PATENT APPEALS
AND INTERFERENCES

Ex parte MAI H. LOC, JOHN A. DICKERSON,
and PETER T. LI

Appeal 2009-1063
Application 10/813,377
Technology Center 2800

Decided:[1] March 27, 2009

Before JOSEPH F. RUGGIERO, ROBERT E. NAPPI,
and JOHN A. JEFFERY, *Administrative Patent Judges*.

JEFFERY, *Administrative Patent Judge*.

DECISION ON APPEAL

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[1] The two-month time period for filing an appeal or commencing a civil action, as recited in 37 C.F.R. § 1.304, begins to run from the decided date shown on this page of the decision. The time period does not run from the Mail Date (paper delivery) or Notification Date (electronic delivery).

Appellants appeal under 35 U.S.C. § 134 from the Examiner's rejection of claims 1-7, 10-13, and 15-19. We have jurisdiction under 35 U.S.C. § 6(b). We affirm.

STATEMENT OF THE CASE

Appellants invented a thermal distribution system for a voltage regulator convertor with multiple phases located on a substrate. Phases that generate more heat than others are located in areas of the substrate that are less thermally sensitive. Such a placement eliminates the need to replace heat-sensitive elements with more heat-tolerant (and expensive) components, or operate the voltage regulator at a lower current level.[2]

Claim 1 is illustrative with the key limitations emphasized:

1. An apparatus comprising:

a substrate;

a voltage regulator converter, the voltage regulator converter comprising N (N>1) phases, each of the N phases located in a respective one of N areas of the substrate; and

a voltage regulator controller coupled to the voltage regulator converter,

wherein a first one of the N phases is to *generate more heat* than a second one of the N phases, and

wherein a first area of the substrate in which the first one of the N phases is located is *less thermally-sensitive* than a second area of the substrate in which the second one of the N phases is located. (emphasis added)

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[2] *See generally* Spec. 1:7–2:23.

The Examiner relies on the following prior art references to show unpatentability:

Rich	US 4,967,201	Oct. 30, 1990
Chang	US 6,218,817 B1	Apr. 17, 2001
Elbanhawy	US 6,449,174 B1	Sep. 10, 2002
Talbot	US 6,865,682 B1	Mar. 8, 2005 (filed Jun. 18, 1999)
Tabaian	US 7,027,944 B2	Apr. 11, 2006 (effectively filed Jun. 30, 2003)

1. The Examiner rejected claims 1 and 15 under 35 U.S.C. § 112, ¶ 2 as being indefinite (Ans. 3).
2. The Examiner rejected claims 1-4, 10-13, and 15 under 35 U.S.C. § 103(a) as unpatentable over Elbanhawy, Rich, and Tabaian (Ans. 4-5).
3. The Examiner rejected claims 5-7 and 16-19 under 35 U.S.C. § 103(a) as unpatentable over Chang, Elbanhawy, Rich, and Talbot (Non-final Rej. 4).[3]

Rather than repeat the arguments of Appellants or the Examiner, we refer to the Brief and the Answer[4] for their respective details. In this decision, we have considered only those arguments actually made by

[3] Although the Examiner did not reproduce this rejection in the Answer, it is nevertheless on appeal before us since it is the only rejection of claims 5-7 and 16-19—claims that Appellants indicate are appealed. *See* Br. 2 (indicating that claims 1-7, 10-13, and 15-19 are appealed in the Brief's "Status of Claims" section); *see also* Ans. 2 (confirming that the Brief's "Status of Claims" section is correct).

[4] Throughout this opinion, we refer to the Appeal Brief filed Apr. 17, 2007 and the latest Examiner's Answer mailed Sep. 4, 2007.

Appellants. Arguments which Appellants could have made but did not make in the Brief have not been considered and are deemed to be waived. *See* 37 C.F.R. § 41.37(c)(1)(vii).

THE INDEFINITENESS REJECTION

The Examiner takes the position that the term "thermally sensitive"[5] recited in independent claims 1 and 15 is unclear in light of the Specification. According to the Examiner, since the term is undefined and subject to varying interpretations, the scope of the claim is unclear (Ans. 3, 5, 6).

Appellants argue that ordinarily skilled artisans would readily understand the meaning of the term "thermally sensitive" and the concept of locating phases in areas exhibiting various thermal sensitivity (Br. 4).

The issue before us, then, is as follows:

ISSUE

Have Appellants shown that the Examiner erred in finding that reciting relative "thermal sensitivities" associated with different areas of a substrate renders claim 1 indefinite under § 112, second paragraph?

FINDINGS OF FACT

The record supports the following findings of fact (FF) by a preponderance of the evidence:

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[5] Although this term is hyphenated in claim 1, we refer to the term unhyphenated as appropriate for grammatical accuracy.

Appellants' Specification

1. According to the Specification:

> A voltage regulator may consist of several elements that generate significant amounts of heat. These elements may be spaced apart on a substrate, such as a motherboard, to which the voltage regulator is mounted. Over time, these spaced voltage regulator elements may compromise the functionality of heat-sensitive elements located nearby or of the substrate itself. Accordingly, the heat-sensitive elements may be replaced with elements that are more heat-tolerant (and usually more expensive) and/or the voltage regulator may be operated at a lower current level so that the above-described voltage regulator elements generate smaller amounts of heat.

(Spec 1:7-14.)

2. "In some embodiments, voltage regulator converter 14 comprises two or more phases . . . . The phase that generates less heat may be located in an area of a substrate that is more thermally-sensitive than the area in which the other phase is located." (Spec. 2:14-21.)

PRINCIPLES OF LAW

Claims must "particularly point[] out and distinctly claim[] the subject matter which the applicant regards as his invention." 35 U.S.C. § 112, ¶ 2. The test for definiteness under 35 U.S.C. § 112, second paragraph, is whether "those skilled in the art would understand what is claimed when the claim is read in light of the specification." *Orthokinetics, Inc. v. Safety Travel Chairs, Inc.,* 806 F.2d 1565, 1576 (Fed. Cir. 1986) (citations omitted).

Although "[a] claim term is not indefinite just because 'it poses a difficult issue of claim construction[,]'" *Star Scientific, Inc. v. R.J. Reynolds*

Tobacco Co., 537 F.3d 1357, 1371 (Fed. Cir. 2008), "if a claim is amenable to two or more plausible claim constructions, the USPTO is justified in requiring the applicant to more precisely define the metes and bounds of the claimed invention by holding the claim unpatentable under 35 U.S.C. § 112, second paragraph, as indefinite." *Ex parte Miyazaki*, No. 2007-3300, slip op. at 11-12 (BPAI Nov. 19, 2008) (precedential), *available at* http://www.uspto.gov/web/offices/dcom/bpai/prec/fd073300.pdf. A claim's breadth, however, is not equated with indefiniteness. *In re Miller*, 441 F.2d 689, 693 (CCPA 1971).

"[T]he specification is the single best guide to the meaning of a disputed term, and . . . acts as a dictionary when it expressly defines terms in the claims or when it defines terms by implication." *Phillips v. AWH Corp.*, 415 F.3d 1303, 1321 (Fed. Cir. 2005) (en banc) (internal quotation marks and citations omitted).

ANALYSIS

We will not sustain the Examiner's indefiniteness rejection of independent claims 1 and 15[6] which call for, in pertinent part, reciting relative "thermal sensitivities" associated with different areas of a substrate where different heat-generating phases of a voltage regulator converter are located.

[6] We note that the Examiner's indefiniteness rejection is limited to independent claims 1 and 15, yet excludes the dependent claims which would also contain the alleged defect of the independent claims by virtue of their dependency. Furthermore, the Examiner excludes independent claim 10 which contains commensurate limitations. Nevertheless, only the rejection of independent claims 1 and 15 is before us, and our decision is therefore confined to those claims.

In construing the disputed term "thermally sensitive," we first turn to Appellants' Specification, for it is the single best guide in ascertaining the meaning of the term. *See Phillips*, 415 F.3d at 1321. As the Examiner indicates (Ans. 5), the term "thermally sensitive" is not explicitly defined in Appellants' Specification. But the absence of such a definition is hardly dispositive. Based on the record before us, we find that skilled artisans would readily understand the meaning of the term "thermally sensitive" in light of its usage in the Specification contrary to the Examiner's assertion.

Appellants' Specification notes that the heat generated by voltage regulator elements mounted on a substrate can compromise the functionality of nearby heat-sensitive elements or the substrate itself (FF 1). To alleviate this problem, Appellants indicate that conventional solutions included (1) replacing the heat-sensitive elements with more heat-tolerant (and more expensive) components, and (2) lowering the voltage regulator's operating current (*Id.*).

As an alternative, however, the claimed invention contemplates locating phases of a voltage regulator converter that generate less heat in areas of the substrate that are less "thermally sensitive" than other areas (FF 2).

Based on this usage of "thermally sensitive" in the context of the art, skilled artisans would have no trouble discerning its meaning. That is, skilled artisans would readily understand that "thermally sensitive" used in this context pertains to a component's sensitivity to heat, namely in terms of compromising its functionality. *See* FF 1. Furthermore, since heat-sensitive components are typically located near heat-generating voltage regulator

components (FF 1), skilled artisans would recognize that "thermally sensitive" areas of a substrate would include heat-sensitive components.

As such, skilled artisans would also have no trouble discerning relative degrees of thermal sensitivity of different areas of a substrate. That is, skilled artisans would recognize that substrate areas that are more thermally sensitive than others would contain more heat-sensitive components (or less heat-tolerant components) than other areas. *See* FF 1 and 2.

We reach a similar conclusion with respect to the structure of the substrate itself as it, too, can be heat-sensitive such that its functionality can be compromised by heat. *See* FF 1 (noting that the "spaced voltage regulator elements may compromise the functionality of heat-sensitive elements located nearby *or of the substrate itself*") (emphasis added). While the Specification is less clear on this point (*see id.*), skilled artisans could nonetheless reasonably ascertain relative degrees of thermal sensitivity of a substrate in terms of its heat transfer characteristics imparted by its structure, constituent materials, and components mounted thereon.

While the term "thermally sensitive" is broad, it is not indefinite in light of its usage in the Specification. *See Miller*, 441 F.2d at 693 (noting that a claim's breadth is not equated with indefiniteness.). This is not a case where the disputed limitation is amenable to two or more plausible constructions where such an ambiguity renders the claims indefinite. *See Miyazaki*, slip op. at 11-12. Rather, the recited term "thermally sensitive" is simply broad; yet it is reasonably ascertainable by skilled artisans in light of the Specification as noted above.

For the foregoing reasons, Appellants have persuaded us of error in the Examiner's indefiniteness rejection of independent claims 1 and 15. Therefore, we will not sustain the Examiner's rejection of those claims.

THE OBVIOUSNESS REJECTION OVER ELBANHAWY, RICH, AND TABAIAN

Regarding representative claim 1,[7] the Examiner finds that Elbanhawy discloses all claimed subject matter except for locating a phase of the voltage regulator converter that generates more heat in a less thermally-sensitive area of the substrate. The Examiner, however, relies on Rich for teaching locating heat-generating components 84 in less thermally-sensitive areas of a substrate. The Examiner also cites Tabaian for teaching that different phases can generate different amounts of heat due to current mismatches, and concludes that the claimed invention would have been obvious in light of these teachings (Ans. 4-7).

Appellants argue that Rich does not teach or suggest substrate areas that have different thermal sensitivities, let alone locate phases in these areas (Br. 5-6). Appellants add that Tabaian does not cure this deficiency since power is regulated by sharing power equally among all phases of the circuit. As such, Appellants contend, Tabaian does not teach or suggest thermal differences among the phases (*Id.*).

[7] Appellants effectively argue claims 1-4, 10-13, and 15 together as a group. *See* Br. 5-6. Accordingly, we select claim 1 as representative. *See* 37 C.F.R. § 41.37(c)(1)(vii).

The issue before us, then, is as follows:

ISSUE

Have Appellants shown that the Examiner erred in finding that Elbanhawy, Rich, and Tabaian collectively teach or suggest locating a phase of a voltage regulator converter that generates more heat in an area of a substrate that is less thermally sensitive in rejecting claim 1 under § 103?

FINDINGS OF FACT

The record supports the following additional findings of fact (FF) by a preponderance of the evidence:

Elbanhawy

3. Elbanhawy notes that a recognized problem associated with multi-phase power supplies relates to uneven distribution of load currents among the phases of the supply (Elbanhawy, col. 1, ll. 20-29).

4. To alleviate this problem, Elbanhawy balances current among phases of a multi-phase power supply by reducing and controlling the temperature variations among packages (210-1−210-N (Fig. 2), 410-1−410-N (Fig. 4)) within each phase (Elbanhawy, Abstract; col. 3, l. 56 − col. 5, l. 32; col. 6, l. 39 − col. 7, l. 16; Figs. 2 and 4).

5. Each package includes a substantially similar heat sink (Elbanhawy, col. 5, ll. 20-21; col. 8, ll. 5-6).

Rich

6. Rich discloses a microwave transmit/receive module 10 comprising a single multi-layer substrate 20 with at least two opposed mounting surfaces S1 and S2. The substrate includes plural integrated

dielectric layers (L), electrical conductors 22, and thermal conductors 24 selectively interconnected between the layers (Rich, Abstract; col. 2, ll. 49-60; Figs. 1-3).

7. As shown in Figures 1 through 3, a heat sink interface means 60 is (1) mounted on mounting surface S2, and (2) coupled to thermal conductors 24. As such, the heat sink interface means couples or directs thermal energy or waste heat exterior of the housing 12 as shown by the arrow "H." (Rich, col. 3, ll. 7-22; Figs. 1-3.)

8. Circuits or chips 84 and other devices that (1) generate heat, and (2) are sensitive to heat are mounted on substrate 20 on chip carrier 80 at selected locations. These selected locations correspond to locations that are above, or thermally proximate to, the selectively-placed thermal conductors 24. As such, heat generated by the chips 84 is (1) conducted through the substrate from side S1 to side S2 where the heat sink interface means is located, and (2) dissipated away from the heat sensitive chips 84. (Rich, col. 5, ll. 42-61; Figs. 1-3 and 6.)

Tabaian

9. In the Background section, Tabaian notes that due to discrete components and power device mismatches, the load current is not always equally shared among all the phases of multi-phase regulators causing (1) inadequate operation, and (2) excessive heat in the power devices of one or more phases of a multi-phase power supply (Tabaian, col. 1, ll. 15-23).

10. An embodiment of Tabaian's invention adjusts the feedback gain of an adjustable sense amplifier 150 to balance variations in the current

sense circuit 140 of each phase to equalize the load seen by each phase (Tabaian, col. 8, ll. 43-44, 54-58; Fig. 1).

PRINCIPLES OF LAW

In rejecting claims under 35 U.S.C. § 103, it is incumbent upon the Examiner to establish a factual basis to support the legal conclusion of obviousness. *See In re Fine*, 837 F.2d 1071, 1073 (Fed. Cir. 1988). In so doing, the Examiner must make the factual determinations set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 17 (1966).

If the claimed subject matter cannot be fairly characterized as involving the simple substitution of one known element for another or the mere application of a known technique to a piece of prior art ready for the improvement, a holding of obviousness can be based on a showing that "there was an apparent reason to combine the known elements in the fashion claimed." *KSR Int'l v. Teleflex, Inc.*, 550 U.S. 398, 127 S. Ct. 1727, 1740-41 (2007).

If the Examiner's burden is met, the burden then shifts to the Appellants to overcome the prima facie case with argument and/or evidence. Obviousness is then determined on the basis of the evidence as a whole and the relative persuasiveness of the arguments. *See In re Oetiker*, 977 F.2d 1443, 1445 (Fed. Cir. 1992).

ANALYSIS

Based on the record before us, we find no error in the Examiner's obviousness rejection of representative claim 1 which calls for, in pertinent

part, locating a phase of a voltage regulator converter that generates more heat in an area of a substrate that is less thermally sensitive.

In reaching this conclusion, we recognize that Elbanhawy balances current among phases of a multi-phase power supply by reducing and controlling the temperature variations among packages within each phase (FF 4). This current balancing suggests that the respective phases would generate similar—not different—amounts of heat: a suggestion bolstered by Elbanhawy's using substantially similar heat sinks for the packages within each phase (FF 5).

Nevertheless, Elbanhawy recognizes that without these measures, an uneven distribution of load currents among the phases of the supply can result and, likewise, an uneven temperature distribution. *See* FF 3 and 4. This conclusion is further bolstered by Tabaian's recognition that uneven current distribution among the phases of multi-phase regulators causes excessive heat in the power devices of one or more of the phases (FF 9).

In light of this non-uniform heating of the respective phases, we find ample basis on this record suggesting locating hotter phases in areas of a substrate that are less thermally sensitive as claimed. Rich, for example, teaches mounting heat-generating circuits or chips 84 at *selected* locations that are above, or thermally proximate to, *selectively-placed* thermal conductors 24 (FF 8). This selective placement ensures that the heat generated by the circuits or chips is thermally coupled to the underlying thermal conductors 24 and ultimately dissipated away from the chips via the heat sink interface means located on the opposite side of the substrate. *See* FF 7 and 8. This selective placement of the chips in thermal proximity to

the underlying thermal conductors to transfer and dissipate heat via heat sink interface means 60 is shown in Figure 3 of Rich, reproduced below:

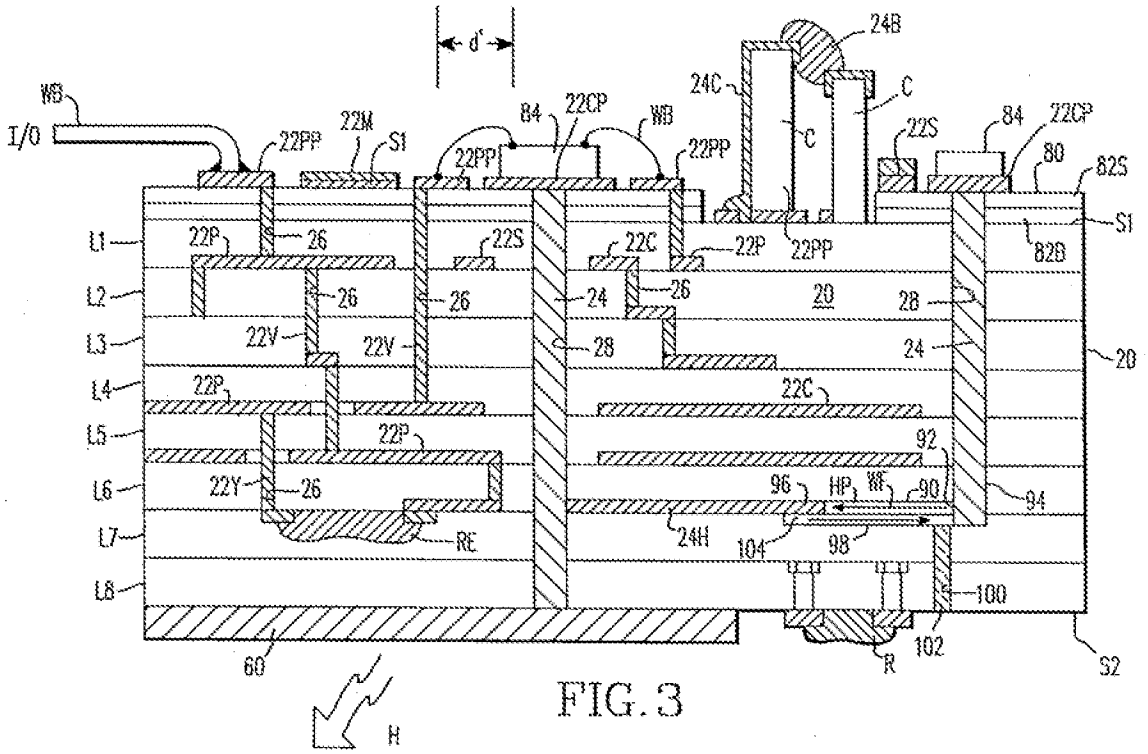

FIG. 3

Reproduction of Rich's Figure 3 Showing Selective Placement of Chips 84 Over Thermal Conductors 24 to Transfer and Dissipate Heat Via Heat Sink Interface Means 60

As shown above, the selected areas above the thermal conductors 24 are less thermally sensitive than other areas of the substrate since, among other things, these areas are actually designed to transfer heat to the opposite side of the substrate. *See* FF 7 and 8. By their very nature, these areas would therefore be less thermally-sensitive (i.e., more tolerant to heat) than other areas of the substrate without these thermal conductors.

Based on these teachings, we therefore see no reason why skilled artisans could not locate hotter phases of a voltage regulator converter in

substrate areas that are less thermally sensitive than others. Such a selective placement is merely a common-sense engineering decision based on fundamental engineering and heat-transfer principles to avoid compromising the functionality of particular nearby components that can be more susceptible to thermal damage than others—a predictable result. *See KSR*, 127 S. Ct. at 1742-43 ("Rigid preventative rules that deny factfinders recourse to common sense . . . are neither necessary under our case law nor consistent with it."); *see also id.* at 1740. In any event, the fact that Rich deliberately locates heat-generating components directly above areas that are more heat-tolerant than others (*see* FF 8) only bolsters our conclusion that skilled artisans would have similarly located hotter phases in less thermally-sensitive areas of a substrate as claimed.

For the foregoing reasons, Appellants have not persuaded us of error in the Examiner's obviousness rejection of representative claim 1. Therefore, we will sustain the Examiner's rejection of that claim, and claims 10-13 and 15 which fall with claim 1.

OTHER OBVIOUSNESS REJECTION

Likewise, we will sustain the Examiner's obviousness rejection of 1, 5-7 and 15-19 over Chang, Elbanhawy, Rich, and Talbot (Non-final Rej. 4). Appellants have not presented any arguments pertaining to this rejection, let alone particularly pointed out errors in the Examiner's reasoning to

persuasively rebut the Examiner's prima facie case of obviousness. Accordingly, we summarily sustain the Examiner's rejection.[8]

CONCLUSIONS

Appellants have shown that the Examiner erred in rejecting claims 1 and 15 under § 112, second paragraph. Appellants, however, have not shown that the Examiner erred in rejecting claims 1-7, 10-13, and 15-19 under § 103.

ORDER

The Examiner's decision rejecting claims 1-7, 10-13, and 15-19 is affirmed.

No time period for taking any subsequent action in connection with this appeal may be extended under 37 C.F.R. § 1.136(a)(1)(iv).

AFFIRMED

KIS

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[8] *See* MPEP § 1205.02, Rev. 3, Aug. 2005 ("If a ground of rejection stated by the examiner is not addressed in the appellant's brief, that ground of rejection will be summarily sustained by the Board.").